III. Approach

CRADA Sampling Selection Process

As of the time of this report, June 1998, there were a total of 2456 DoD CRADAs initiated since the inception of the Technology Transfer Act (TTA) of 1986. Of the 2456 CRADAs, 1256 were completed or closed-out. Initially the study was to focus exclusively on closed CRADAs, but this approach had numerous difficulties. Some of the difficulties encountered were 1) finding federal POCs who had retired or left the Government and 2) finding non-federal POCs whose companies no longer existed. Furthermore, there is not a requirement for a final or exit summary report. As a result, closed CRADAs as well as CRADAs that were open and had already exhibited some progress were considered in this study.

The CRADAs evaluated in this study may not be typical of the quality of all CRADAs. Since there is no requirement to track the outcomes of CRADAs, there may be CRADAs that have been notable, but their story has not been captured for multiple reasons such as, retirements and/or base closures. In addition, there is no common definition of value (i.e. metrics) other than through the stated objectives in the statement-of-work (and that the objectives be consistent with the laboratory mission). Therefore, it was determined that the most practical approach was to focus on the information from those CRADAs that were available and recommended by the Offices of Research and Technology Applications (ORTAs) as well as from interviews with CRADA participants.

This study is not meant to be comprehensive. Since it was not practical to evaluate all CRADAs, a sampling of 30 CRADAs were chosen for evaluation from a total of 131 CRADAs identified for this study. The majority of the CRADAs were nominated from the ORTAs at locations selected by the Technology Transfer Service Managers and judged to be of inherent value based on the laboratories' missions. Others were gathered from publications such as the Federal Laboratory Consortium *NewsLink*, Technology Business Magazine, Technology '95 (an Army publication), the 1996 In-House R&D Activity Report, and DoD laboratory web sites.

Of these 131 CRADAs, 86 CRADAs were chosen for further review based on whether they were closed or were open and already showing progress. Some were eliminated from the study if the sole benefit was to the non-federal partner. The final 30 CRADAs, 10 from each Service, that best illustrated value back to DoD were chosen based on availability of information and points-of-contact. A schematic of the downselection process is depicted in Figure 4.

Summaries of the 30 CRADAs selected for evaluation are provided in the appendices. These summaries are based on background information gathered from the original sources as well as interviews and correspondence with the points-of-contact. Information in the summaries were drawn upon to support the findings and benefits associated with CRADAs.

The interviews and analysis conducted for this study were performed from June 1998 through September 1998. Interview guides were used to conduct telephone interviews with both federal and non-federal CRADA POCs. In some cases the non-federal partner was not available to be interviewed. The interviews were open-ended in order to gain a better understanding of organizational motivations and salient issues. A copy of the interview guides are included in the appendices.

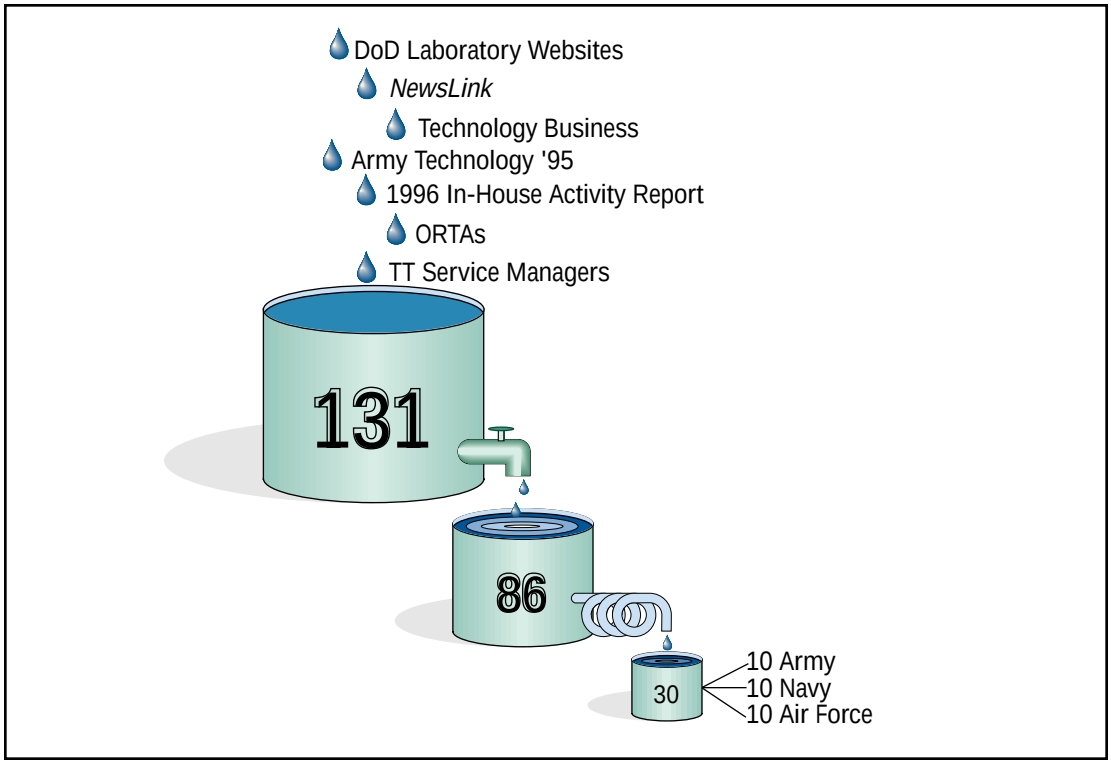

Figure 4. CRADA Sample Selection Process

Assessing the Benefits of CRADAs to DoD

DoD has developed five management principles to guide in the development of the elements of the S&T programs of the Military Departments and Defense Agencies.

Guiding Management Principles of the DoD S&T Program

- Transition Technology to Address Warfighting Needs
- Reduce Cost
- Strengthen the Industrial Base
- Promote Basic Research
- Assure Quality

Aligning each CRADA to at least one of the five management principles from the Defense Science and Technology Strategy[26] was the primary method used in assessing the value of CRADAs to DoD. Additional anecdotal information supporting the success and value of CRADAs to DoD was gathered through interviewing both the federal and non-federal partners involved in the collaborations.

Within each of these management principles are broad criteria that DoD technology programs must meet. The following is a summary of the criteria for the five management principles outlined in the Defense Science and Technology Strategy.

Transition Technology to Address Warfighting Needs

- Work with Warfighters
- Ensure that Joint Needs are Met
- Insert Promising Concepts into Development Programs Rapidly
- Insert Technology into In-Service System
- Prevent Technological Surprise

- Work with the Warfighters: Since it is the warfighters who must determine what capabilities are needed and therefore what systems will be purchased, technologists in the labs need to work with the users to articulate capability needs in order to match them with new technology opportunities.
- Ensure that Joint Needs are Met: The DoD S&T program gives high priority to joint needs, and ensures that technologies are being developed to serve joint forces. (i.e. integration of sensors, weapons, communications, situation displays, and navigation systems across the Services)
- Insert Promising Concepts into Development Programs Rapidly: Technology must move through a continuum rapidly, from new concept to research to technology exploration in the laboratory so that technology can be transitioned into military systems rapidly.
- Insert Technology into In-Service Systems: In-service systems should be upgraded with defense-unique, commercial-of-the-shelf (COTS), or subsystems (software, electronics, self-contained subsystems) whenever possible.
- Prevent Technological Surprise: Good intelligence is needed on weapon availability and the military concepts of potential adversaries. The S&T community must maintain a continuing awareness of emerging technology that could have military applications.

Reduce Cost (both acquisition and life cycle costs)

- Insert Technologies that Reduce the Cost of Ownership
- Use the Best Commercial Products, Practices, and Processes
- Simulate
- Improve Manufacturing Processes
- Consider Environmental Factors

- Insert Technologies that Reduce the Cost of Ownership: Technologists need to seek out technology and applications that reduce the cost of operating, maintaining, and upgrading systems and insert those technologies at every stage of the system's acquisition and life-cycle.
- Use the Best Commercial Products, Practices, and Processes: Exploit national and international commercial practices, standards, technologies, products, and protocols as the rule, rather than the exception. DoD-unique items need to be manufactured on flexible production lines. DoD needs to benefit from economies of scale.
- Simulate: The use of simulation allows technologists and warfighters to collaborate earlier in the development process, and provides users the means for a more thorough evaluation of concepts leading to substantial cost reductions.
- Improve Manufacturing Processes: Focus on easily reconfigurable manufacturing equipment that allows economical, variable-volume lot runs; integrated product and process development that permits production analysis during product design and tailoring of both product and process; and cost reduction of the combination of technology and manufacturing.
- Consider Environmental Factors: Develop and harness technologies to reduce the production of pollutants, reduce the cost of environmental clean-up and restoration, destroy munitions and systems in a more environmentally benign way, and isolate environmentally hazardous substances more reliably, at less cost and for a longer time. Address environmental issues early in the design phase of a new system.

Strengthen the Industrial Base

- Develop Dual-Use Technologies and Processes
- Sustain Service-Essential Disciplines and Industries
- Sustain Investment in Priority Technologies
- Exploit Commercial Technologies
- Strengthen Technology Transfer
- Field Selected Initiatives to Apply Technology to Societal Needs

- Develop Dual-Use Technologies and Processes: Dual-use refers to technologies, processes, and products with both military and nonmilitary applications.
- Sustain Service-Essential Disciplines and Industries: The Military Departments must bear the cost and responsibility for advancing these technologies and nurturing the research and development component of those industries.
- Sustain Investment in Priority Technologies: The current long-term investment initiatives in technology maturation include multi-chip modules, uncooled infrared focal plane arrays, microelectrical-mechanical systems, lithography, flat panel displays, titanium metal matrix composites, nano-manufacturing, and optical electronics.
- Exploit Commercial Technologies: The Services must monitor commercial product offerings and be the catalyst for the adoption of such products where they offer advantages. Incentives must be created to catalyze and facilitate insertion of commercial technology into defense systems.
- Strengthen Technology Transfer: DoD needs to ensure exploitation of commercial technology and nurture technology transfer among in-house laboratories, industry, universities and not-for-profit laboratories. Encourage shared use of facilities, and participation in regional, state and local alliances.
- Field Selected Initiatives to Apply Technology to Societal Needs: DoD will identify economic and societal needs where it has special ability to lead in the application of technology. These needs include counter-proliferation, environmental compliance, aviation, energy, infectious disease originating outside the US, and information systems.

Promote Basic Research

- Support Quality Basic Research
- Select Research Performers Based on Merit
- Sustain Stable Research Funding
- Promote Teamwork and Partnerships

- Support Quality Basic Research: DoD requires a basic research program to assure that it has early cognizance of new scientific ideas. DoD sustains its investment in basic research because it has proven experience of significant, long term benefits to the Military.
- Select Research Performers Based on Merit: Merit based selection of projects ensures quality.
- Sustain Stable Research Funding: To ensure that a supply of technical talent will continue, DoD must sustain its long-standing commitment to support students studying science and engineering. It continues the small, but important, programs to bring students to the Defense laboratories on cooperative or other arrangements in order to involve them first-hand in defense programs.
- Promote Teamwork and Partnerships: The DoD basic research program fosters teamwork and partnerships of many forms: DoD laboratory researchers teaming with in-service material engineers in the laboratories to explore jointly the symptoms of component failure; Defense laboratory scientists teaming with university or industrial scientists, perhaps drawn together to share use of laboratory equipment or instruments; consortia of universities and industry; and allies. Many programs involve close coordination between DoD and other government agencies.

Assure Quality

- Downsize, Outsource, and Restructure the DoD RDT&E
- Retain a Critical Mass of Internal Expertise
- Encourage Innovation
- Strengthen Defense S&T Reliance
- Monitor and Collaborate International Science Efforts

- Downsize, Outsource, and Restructure the DoD RDT&E Infrastructure: Today it may be more effective to rely on industry or universities for those technologies that are developing outside DoD at a rapid pace. Those portions of the infrastructure that are critical to the future must be retained, restructured as necessary, strengthened, and sized so as to be supportable with future DoD budgets.
- Retain a Critical Mass of Internal Expertise: Core competencies in military relevant technologies must be maintained.
- Encourage Innovation: The S&T leadership is responsible for encouraging innovation while at the same time allocating resources prudently.
- Strengthen Defense S&T Reliance: Defense S&T Reliance is an important vehicle for ensuring that the research efforts of the Military Departments and Defense Agencies are fully coordinated and not duplicative.
- Monitor and Collaborate International Science Efforts: No longer does the U.S. dominate world science and technology. Where appropriate, an increase in collaboration is needed with allies and emerging democracies, including the countries of the former Soviet Union, to reduce the possibility of technological surprise and ensure that access to leading edge research and key technology development is maintained.